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Integration of biochemistry into an organ system based medical curriculum using problem based learning

Babu Raja Maharjan,[1] Bibek Upadhya Parajuli,[2] Prem Raj Shakya[2]

[1]Associate Professor, [2]Lecturer, Department of Biochemistry, School of Medicine, Patan Academy of Health Sciences, Lalitpur, Nepal

Abstract

Medical schools devote considerable time to impart knowledge of biochemistry to medical students for the effective practice of clinical medicine. However, there is a challenge to effectively deliver the biochemistry curriculum in an appropriate clinical context. At Patan Academy of Health Sciences different strategies were under taken to integrate biochemistry curriculum with other basic science disciplines in the context of organ system based curriculum during the undergraduate, curriculum development. Although major portion of the curriculum is covered using PBL; seminars and laboratory sessions along with lectures were also used. After the implementation of curriculum, in-depth interview was used to analyze students' perception on biochemistry curriculum integration. The analysis revealed that students were convinced with the arrangement of curricular content and integrated delivery through PBL, lecture and practical sessions in different blocks except for Principles of Human Biology (PHB) I and PHB II.

Keywords: basic science, integrated curriculum, biochemistry, PBL, undergraduate medical student

Correspondence
Dr. Babu Raja Maharjan
Department of Biochemistry
School of Medicine, Patan Academy of Health Sciences
Lalitpur, Nepal
Email: baburajamaharjan@pahs.edu.np

Peer Reviewers
Prof. Dr. Madhusudan Subedi
Patan Academy of Health Sciences

Prof. Dr. Jay Narayan Shah
Patan Academy of Health Sciences

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Perspective

There is widespread concern among clinicians and medical educators that basic science knowledge learned during the traditional preclinical years have substantial loss of by the time medical students reach clinical years.[1,2] The decline in retention of biochemistry knowledge was even greater than for other basic science disciplines.[3] Learning theory reveals that learning is best accomplished and retained when information is presented in a meaningful and integrated pattern.[4,5] It has also been shown that integrated medical curricula are more effective than conventional curricula. [6-8]

The problem based learning (PBL) provides a suitable platform to integrate biochemistry curricular content with all the other basic and clinical sciences by using relevant clinical case scenarios.[9] In this study we have described how biochemistry curricular content is integrated through PBL at Patan Academy of Health Sciences (PAHS and other teaching learning strategies undertaken to foster active learning.

Strategies under taken to align biochemistry curricular content

The PAHS MBBS curriculum was developed through consultative meetings and workshops during 2005 to 2007 involving national and international academics along with stake holders in health care services to address the health care disparity between rural and urban areas

The curriculum includes two years of basic sciences delivered through integrated organ system using PBL teaching/learning (T/L) to foster retention of basic science knowledge in later clinical years for in-depth lifelong learning and enhance generic skills of communication, leadership, and teamwork.

The curriculum includes two foundation blocks of principle of human biology (PHB) I and II and the eight organ system blocks (OSB) (supplementary file 01, Table 1). The content of biochemistry at PAHS, reviewed the contents from within the country (Tribhuvan University, Kathmandu University and BP Koirala Institute of Health Sciences) overseas universities (University of Newcastle, Australia and University of British Columbia, Canada) for validated and finalized by local faculties for delivery in blocks, (supplementary file, Table 2a,b,c) to assist the students gain foundations in year one, similar to other medical college.[10] For active learning and retention of knowledge[11] via PBLs followed by seminars, assignments, laboratory sessions and supplemented by lectures for more difficult concepts uncovered by active T/L approaches, (Figure 1).

The temporal sequencing of PBL cases, seminars, lab sessions and lectures were found to complement and reinforce learning.[12-14] The PBL case scenarios discussed during the week were reintroduced in subsequent lectures and laboratory sessions to contextualize the learning and to bridge gaps, as well as foster generic skills (communication, team work, critical thinking and self-directed learning).[15,16] Spiral integration approach was also undertaken to enhance learning made in earlier blocks. For example, the metabolism content was mapped initially to the basis of metabolism (glycolysis, TCA cycle, beta oxidation and gluconeogenesis) in PHB I. It was then mapped to the OSB, for example, cardiac muscle metabolism and lipid metabolism in the "cardiovascular system (CVS) block", muscle metabolism in the "musculoskeletal and skin block" and hormonal regulation of metabolism in the "endocrinology block", (Supplementary file, Table 3).

The PBL case was constructed with a relevant clinical scenario to cover learning objectives of basic sciences curriculum including biochemistry. The clinical scenario was partitioned into multiple episodes (triggers) and was administered to students in a sequence. Though the initial triggers generate a very broad discussion, the sequential unfolding of clinical clues guides students to narrow down a discussion and to reach to a clinical diagnosis. There were three PBL sessions of 2 hours each where students

discuss the triggers given by a trained tutor. Seven jump PBL approach was taken during PBL discussion.[17] Tutor's primary responsibility was to facilitate the discussion ensuring intended learning objectives.

In the OSB, the clinical presentations triggered much more student led discussions and achieved the intended biochemistry learning, for example the PBL case of hepatitis in 'gastrointestinal and hepatobiliary block', (Supplementary file 01, Table 4).

The assessment drives learning of medical students.[18,19] The integrated formative and summative assessment using clinical or experimental vignette based multiple choice questions (MCQ), problem based questions (PBQ) and structured viva are used at PAHS. Laboratory skills were assessed through observed structured practical exam. Assessment of generic skills was done by tutors through validated tools during PBL.

Students' perception on the integration of biochemistry curriculum in basic sciences

In December 2012, after the completion of two-year basic sciences, eight students were identified for in-depth recorded interview (supplement file, interview) in both Nepali and English language with open ended questions for the perception on biochemistry curriculum integration. At the conclusion of interviews, first author (BRM) transcribed the recorded interviews and compared with the notes taken during the interview. Nepali script was translated into English by BRM.

Overall perception on the arrangement from simple to complex content was good. For example, in PHB I the nature of biomolecules was delivered early on followed by the dynamics of biomolecules (inter-convertibility of biomolecules) in the basic metabolism section. Students perceived that biochemistry content in PHB I and PHB II was very heavy and not well integrated like in OSB. A spiral arrangement of biochemistry curriculum gives students an opportunity to obtain a simpler understanding initially and to build on this with a deeper knowledge at a later point in time.[20] This repetitive learning not only helps students to have a more comprehensive overview of the subject but also to achieve a better retention of knowledge.[21]

There is increasing trend to use PBL to deliver biochemistry curriculum in medical schools in Nepal.[22]

Conclusions

In-depth interview of students shows spiral integration of biochemistry content with clinically relevant problem based learning as main approach is well accepted by undergraduate medical students at PAHS to foster deeper and lifelong learning. Students agreed that there was better integration of the content with other disciplines in organ system blocks. Some students felt the biochemistry curricular content was heavy in the early period of principle of human biology I and II.

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Supplementary Files

i. Table 1
ii. Table 2
iii. Table 3
iv. Table 4
v. Table 5
vi. Table 6

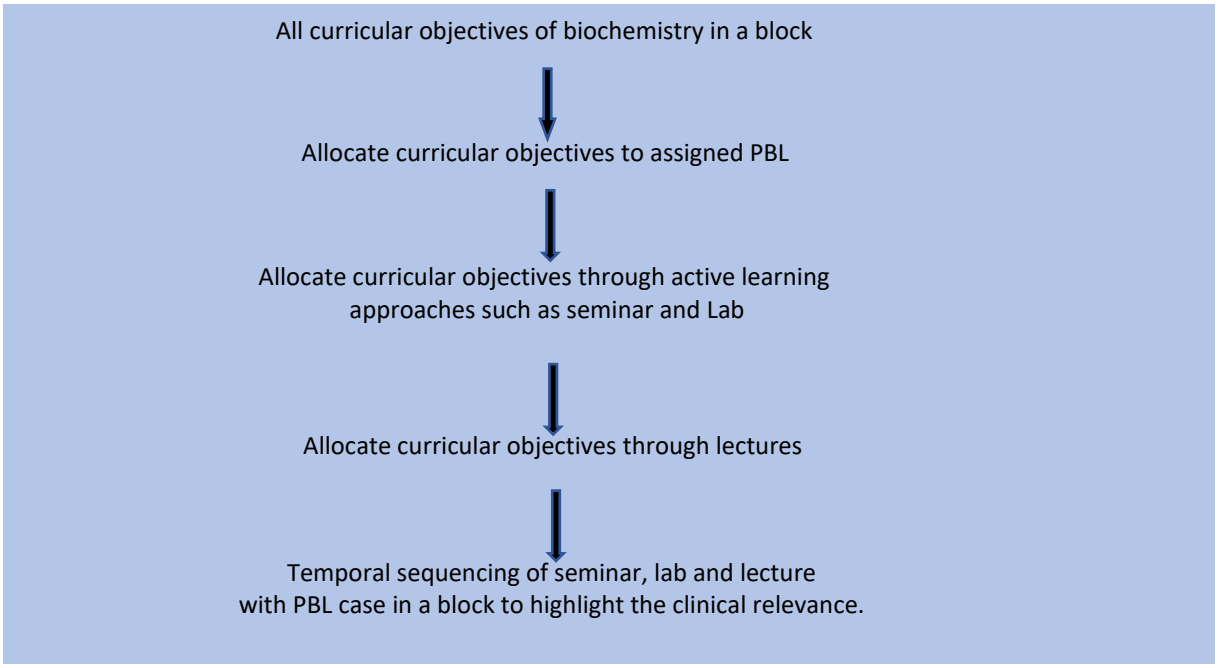

Figure 1: Strategies of distributing biochemistry curriculum in a block to prioritize active learning

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